THE FIRST RECORD AND DESCRIPTION OF A MALE IMAGO OF *AUSTREMERELLA PICTA* RIEK (EPHEMEROPTERA: EPHEMERELLIDAE)

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Abstract

Austremerella picta Riek was originally described in 1963 from nymphs and female imagos from Lamington National Park in Queensland. A male subimago and a male imago were collected at light traps in 2011 and 2012 respectively. Association of the nymphs with the adults was made using a fragment of the CO1 gene. The subimago and imago are here described to complete the life series for the species.

Introduction

The only species of the mayfly family Ephemerellidae known from Australia is *Austremerella picta* Riek, 1963, which was described from nymphal and adult female material from a small stream in Lamington National Park [Queensland] (Riek 1963). No further locality information exists for the type series, which consists of a nymph (designated the holotype) and three female paratypes: two imagos and a damaged subimago. The nymph is clearly distinctive and differs from all other known Australian mayfly nymphs.

The distribution of this species was extended into New South Wales, where the nymphs were found to occupy leaf packs in flowing water, by Chessman and Boulton (1999). Male adults have not been recorded even though additional sites have been recognised. However, recent collections from Lamington National Park included a male subimago and an imago, both clearly belonging in the Ephemerellidae and from the same area as the type series. Nymphs and a male subimago collected from the same stream as the male imago were associated using a fragment of the CO1 gene. The male imago is described here to complete the descriptions of all life stages.

Methods

The subimago and imago were collected using a black light and nymphs were collected from leaf packs in the stream. Nymphs and adults were associated using a fragment of the CO1 gene (assigned GenBank accession numbers KF740665-KF740670) following the methods of Mynott *et al.* (2011).

Association of nymphs and adults

Genetic material was extracted from the subimago and five nymphs of *Austremerella picta* (see 'material examined' below) to associate the life stages and assess the species delimitation. Specimens from the northern and southern ends of the known distribution range (Chessman and Boulton 1999) were sequenced. The nymphs and subimago sequenced from Lamington National Park formed a distinct genetic clade (Fig. 1) that confirmed the association of the life stages. Additionally, the genetic data supported

Austremerella picta as a single species, with less than 1% sequence divergence between the southern (JWA2904, JWA2905, JWA2711) and northern (JWA2710, JWA2712, JWA2713) populations.

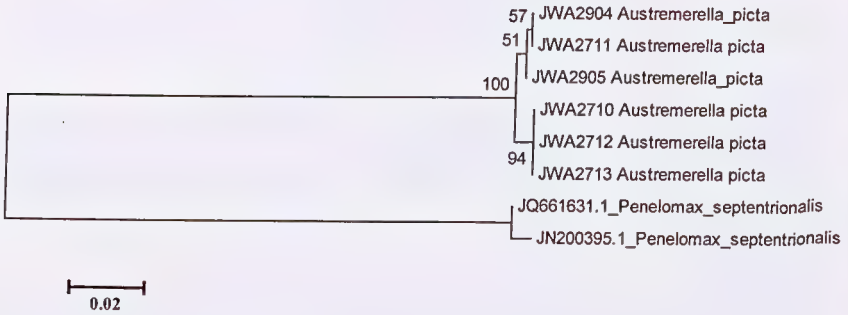


Fig. 1. Neighbour-joining tree with bootstrap supports shown (2000 replications). Distance between *Austremerella* clades <1% (p-distance). Outgroup data were sourced from GenBank (Accession numbers: JN200395.1 and JQ561531.1, both *Penelomax septentrionalis*).

Austremerella picta Riek

(Figs 2-7)

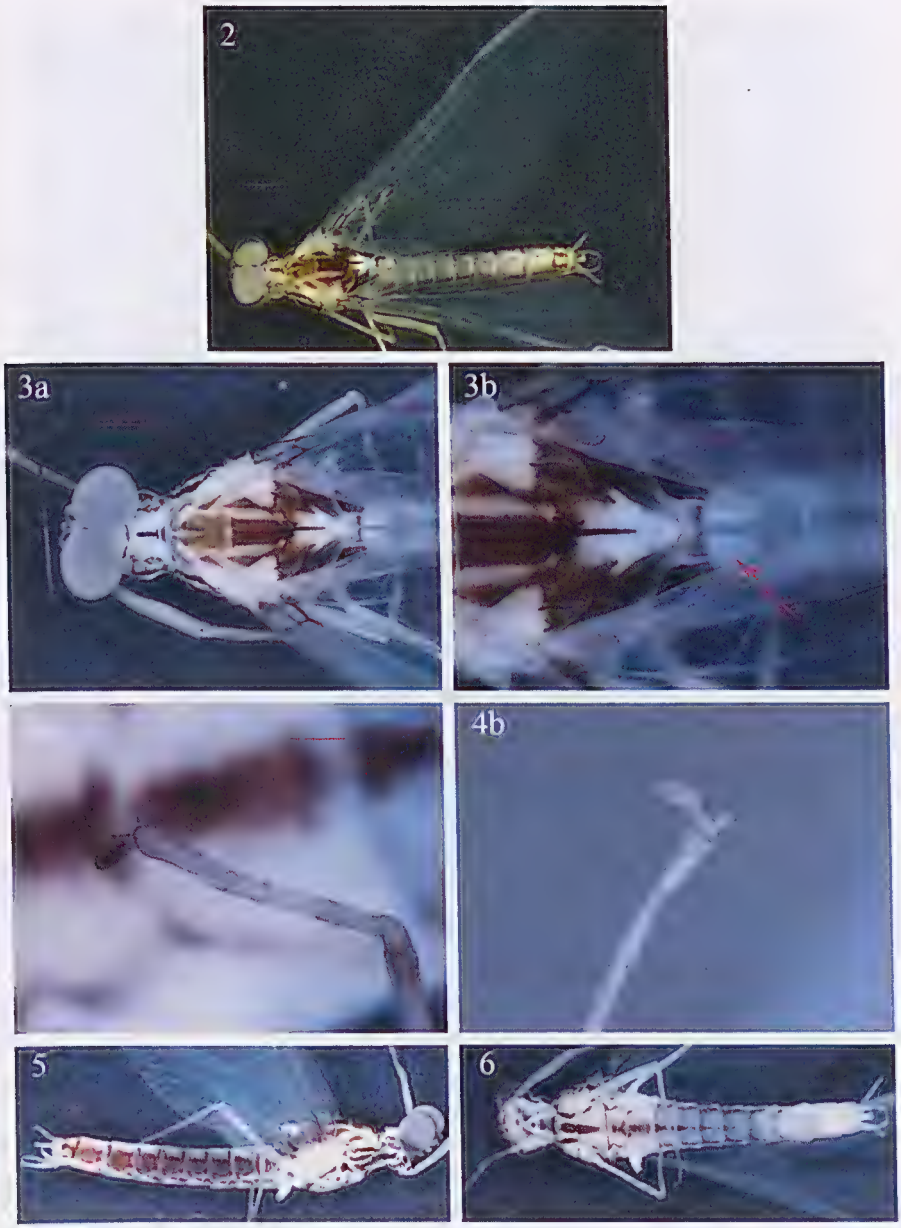
Austremerella picta Riek, 1963: Riek 1970; McCafferty and Wang 1997; Chessman and Boulton 1999; Hubbard 2002; Kluge 2004.

Ephemerellina (*Austremerella*) *picta*: Allen 1965; Campbell 1990; Peters and Campbell 1991.

Material examined. QUEENSLAND: 1 ♂ imago, Morans Creek above Morans Falls, Lamington National Park (O'Reillys), -28.2318°S 153.125°E, 16.xi.2012, J. Mynott and D. Black; 1 ♂ subimago, same location as imago, 17.xi.2011, J. Mynott and M. Shackleton (Accession number: JWA2710). Deposited in the Australian National Insect Collection (ANIC Registration No. 06-000001), along with the original type series.

Nymphs: QUEENSLAND: Morans Creek above Morans Falls, Lamington National Park (O'Reillys), -28.2318°S 153.125°E, 17.xi.2011, J. Mynott and M. Shackleton (Accession numbers: JWA2712; JWA2713). NEW SOUTH WALES: Coppernook Creek crossing Dorrigo-Coffs Harbour Road, Dorrigo National Park, -30.2925°S 152.8178°E, 10.xi.2010, J. Mynott and M. Shackleton (Accession numbers: JWA2904; JWA2905); Allyn River (upper), Allyn River Road, Barrington Tops National Park, -32.1292°S 151.4733°E, 14.xi.2011, J. Mynott and M. Shackleton (Accession number: JWA2711).

Description of male imago (Fig. 2). Body length 10 mm. Fore and hind wings hyaline with distal area of costal and sub-costal region white/opaque; forewing length 11.25 mm, width 3.75 mm; hindwing length 2.20 mm, width 1.10 mm.



Figs 2-6. *Austremerella picta*, male: (2) dorsal view of imago. Scale line = 1 mm; (3) dorsal view of (a) head and thorax; (b) enlarged mesothoracic filaments indicated by arrow. Scale line = 1 mm; (4) tarsal claws: (a) middle leg, (b) hind leg. Scale line = 0.2 mm; (5) lateral colour pattern of imago. Scale line = 1 mm; (6) ventral colour pattern of imago. Scale line = 1 mm.

Eyes grey dorsally, meeting on meson of head, ventral eyes black. Pronotum white with central brown stripe and lateral brown marking. Mesonotum striped, brown and white, white anteriorly and laterally, hind margins white with central black stripe, brown laterally; long fine filament (0.52 mm) present near hind margin (Fig. 3). Metanotum brown.

Wing venation with costal crossveins 8 distal of bullae, 1 proximal, pterostigma region with fine net-like veinlets, Sc crossveins 7 distal of bullae and 2 proximal, Rs forked in proximal third of wing, MA forked in proximal half, MP1 not forked; MP2 joins MP1 in proximal quarter, CuA joins CuP near base of wing, intercalaries single and not attached to main veins.

Hind wing: C meets Sc almost at apex of wing slightly concave, costal region with 8 cross veins in distal half, no cross veins in proximal half, subcostal region with 5 cross veins. Wing venation as shown by Riek (1963).

Foreleg lacking tarsal segments, buff coloured, brown at joints; leg segment ratios 1.0 (2.00 mm):1.2: - . Middle and hind legs buff brown at joints, first tarsal segment partially fused in middle leg, fused in hind leg; middle leg segment ratios 1.0 (1.9 mm): 1.2: - : 0.01: 0.01: 0.05: 0.18; hind leg segment ratios 1.0 (2.4 mm): 0.96: - : 0.075: 0.063: 0.042: 0.104. Tarsal claws paired, dissimilar, one pad-like and one a short narrow blunt claw (Fig. 4).

Abdomen: dorsal colour pattern white centrally with thick brown lateral markings (Fig. 2); segments 1-8 with fine brown line medially, broader on segment 9 and only in anterior half of segment 10. Lateral pattern (Fig. 5) red-brown on tergites, white dorsally. When alive the white areas were distinctly yellow, which was lost after preservation in ethanol. Ventral colour pattern (Fig. 6); similar to the dorsal pattern.

Male genitalia (Fig. 7): penes fused over almost entire length, bulbous distally with slight indentation medially, no ornamentation present. Forceps 3-segmented with basal segment rectangular, length 2x width, second segment elongate, 1.2x basal segment length and third segment short and elongate, triangular, 0.4x length of basal segment.

Terminal filaments and cerci broken.

Male subimago. Body length 8 mm. Fore and hind wings dark grey and opaque, forewing length 10 mm, width 3.6 mm; hindwing length 2.25 mm, width 1.27 mm. Wing venation as for imago. Mesothorax with a pair of posterior projections. Foreleg 5.0 mm long, buff coloured but with tarsi and apex of tibia brown; leg segment ratios - 1.0 (1.5 mm): 1.4 : 0.05 : 0.34 : 0.27 : 0.20 : 0.15. Middle and hind legs buff without markings, first tarsal segment partially fused in middle leg, fused in hind leg; middle leg segment ratios – 1.0 (1.7 mm): 1.18 : 0.08 : 0.09 : 0.08 : 0.04 : 0.19; hind leg segment ratios – 1.0 (1.6 mm): 1.21 : - : 0.06 : 0.06 : 0.05 : 0.2.

Fig. 7. *Austremerella picta,* male genitalia: (a) dorsal view, (b) ventral view, (c) lateral view. Scale lines = 0.2 mm.

Discussion

Riek (1963) described the nymph and female imago of *Austremerella picta* but illustrated only the fore and hind wings of the imago. Riek (1963, p. 50) noted that the venation was similar to *Ephemerella* and the 'wings and body pinkish with some brownish hues'. He also noted the presence of long fine filaments on the mesothorax. The male imago described here lacks this coloration but when alive is a distinct yellow colour, although the wings are hyaline. The original diagnosis for the genus was based on the nymphs and recorded gills on segments 2-6 (Riek 1963). McCafferty and Wang (1997) illustrated the mesothoracic filaments of the female and noted that the nymphs had gills present on abdominal segments 2-7 and female imagos also

had gill socket vestiges on abdominal segments 2-7. Kluge (2004) also noted the presence of the small vestigial gills that are covered by the gill on abdominal segment 6.

The male imago described above is consistent with the wing characteristics and also has the long fine mesothoracic filaments. Association of the life stages was confirmed using genetic data. Additionally, the genetic data supported *Austremerella picta* as a single species ranging from southern Queensland to north of the Hunter River in New South Wales.

Austremerella picta can be distinguished from all other Australian adult mayflies by the presence of the thoracic filaments, dissimilar tarsal claws and forewing with single, free marginal intercalaries.

Acknowledgements

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